

SEM basic operation guide (User's manual)



This document is intended to guide for the basic operation of the system. For detailed information please refer to the operation manual provided by Hitachi.

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Basic Operation Procedure for SEM

Starting the system

1. Turn key to 'Start' then release to 'On' (like starting a car)
2. Turn on the computer 'monitors' (login ID: pc-sem; password: sem)
3. A window will pop up to launch pc-sem software, just click 'ok' (no password; leave blank)
4. Turn on IR camera illumination and screen (Watch if stage is down and chamber looks normal, if **NOT** please **DO NOT** proceed, call for help)

Preparing sample for imaging

1. Cut your sample to appropriate size (length, width & height) that can appropriately fit in the system.
2. Make sure the sample is free of contamination before putting in chamber
3. Mount sample on a sample holder appropriate to its size
4. Affix the sample to sample holder with carbon tape or silver paint (Necessary)
5. If the sample and substrate is insulating it is recommended to deposit ~5-10 nm Gold on the sample before start imaging
6. Do not use any sample without permission which can majorly contaminate the chamber (especially volatile samples, biological or dairy samples...). **SPECIAL PERMISSION WILL BE REQUIRED TO IMAGE SUCH SAMPLES**

Loading sample

1. Screw sample holder onto the brass pedestal
2. Measure sample size (length, width & height) using SEM measurement gauge kept on SEM table (**IMPORTANT**)

3. Press the 'Air' button on front panel of SEM and hold for 1 second
4. Wait until the chamber is purged completely (You can hear the three beep sound and also can look the message in the down left corner of system, 'chamber is aired and ready to change sample'.
5. 'Open' the chamber by pulling gently with both hands. **DO NOT** force open the chamber
6. Place sample firmly into stage
7. Close the chamber
8. Press the chamber door gently with one hand and press the 'Evac' button on the front of SEM.
9. Input 'sample size' and 'sample height' in the pop up window of SEM software (Make sure to input accurate data measured in step 2 of Loading sample section), then press 'ok'
10. Using the 'stage' tab on the SEM application, raise the stage to 12 mm
11. When raising the stage, **CAREFULLY WATCH THE IR CAMERA IMAGE!** If a sample were to be raised too far and strike the backscatter detector, the damage would be catastrophic. Keep the mouse cursor on the large '**STOP**' button in the right-hand corner of the screen and prepare to stop the sample if it gets too close to the detector.

Imaging the sample

1. Wait up till high vacuum gets ready. You will hear a long beep and receive a message in the bottom left corner of pc-sem window 'HV-ready'
2. Once the display shows HV ready **wait for 30 sec** then press HV 'ON' in the operation panel of pc-sem which is usually available after HV is ready. Please **DO NOT TURN HV ON BEFORE VACUUM GETS**

READY. It will be dangerous for both user and the system to turn it on before HV gets ready.

3. Adjust the voltage in operational panel appropriate to the sample being imaged. Preferred voltages for biological and other insulating and soft samples 5 kV, good conducting samples 15 – 30 kV. Maximum range of voltage is 30 kV
4. Recommended important parameter setting instructions in the operation panel (**Advanced training required to play with these parameters**)
 - a. Filament current: Less than 80
 - b. Gun bias: 0 (Please DO NOT change this setting at all)
 - c. Probe current (PC): $30 < PC < 80$ (depending on your sample)
 - d. DO NOT use/change 'ABS', 'AFS', 'Degauss', 'Resolution', 'Working distance' and 'Auto gun bias' settings in ANY CIRCUMSTANCES.
5. Please DO NOT use manual aperture settings from the knob in SEM in ANY CIRCUMSTANCES (**Advanced training required to use this**)
6. Once the HV is turned on and above mentioned settings are performed appropriately, you are ready to start imaging. Use Magnification, coarse & fine focus, brightness & contrast and astigmatism correction knobs to get images.

Capturing & saving images

1. Press the 'Image Capture' button to capture images
2. The SEM will capture an image of the current picture
3. Press the 'Run' button on tool bar to resume back to imaging
4. To save the captured images, click the thumbnail version of it and then click PCI to save it. Specify path for saving it; 'users' folder is in the C-drive. Any images saved other than your specified location in the

users folder is subject to deletion without any information. It is users responsibility to create their own folder in 'users' and save their data in their own folders. **(USE PCI to save images)**

Turning off the system

1. Turn 'OFF' the HV (**VERY IMPORTANT**)
2. Press 'HOME Z 65' button in the stage panel
3. The stage panel will be deactivated and the sample stage will start going down to reset the system
4. Once the system will be reset, the stage panel will be activated
5. Press 'Air' button (as mentioned in section 3 of loading sample). **“DO NOT PRESS AIR BUTTON BEFORE HV IS TURNED OFF”**.
6. Follow the procedure 1 – 5 of Loading sample section
7. Take the sample out with sample holder
8. Close the chamber gently and follow the procedure 8 of section of Loading samples
9. Wait up till vacuum gets ready (follow the instruction mentioned in part 1 of section 'Imaging the sample'.
10. Once the HV is ready, 'Exit' the software from File menu
11. Shut down the computer
12. Turn off the monitor
13. Turn off the IR camera
14. Turn the SEM key to off position
15. Clean the sample preparation area

Safety Notes

1. **DO NOT** go behind the SEM
2. **DO NOT** turn on high voltage without vacuum

3. **DO NOT** air the chamber while HV is on
4. **DO NOT** leave the HV on when not in use for long time
5. **DO NOT** leave the system when HV is on
6. If you are not an authorized user please **DO NOT** use the system unsupervised
7. Be very careful not to allow the sample to hit the backscatter detector!
Watch the IR camera carefully when the stage is in motion.

Additional readings required to operate SEM

Please refer to the following pages of the SEM manual located near SEM in clean room

Pages: 3-1 till 3-4; 3-9 till 3-30; 3-46 till 3-49; 3-57 and 3-157 till 3-159

For visual instructions please refer to the tutorials posted on the MCL website